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Companies' growth in the EU: What is research and innovation policy's role?

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Abstract

One of the main objectives of the new European research and innovation policy agenda is to favour the positive demographics (creation and growth) of EU companies operating in new/knowledge-intensive industries, especially Small and Medium Enterprises (SMEs). These companies play an important role in shaping the dynamism of the economy's sectoral composition, favouring the transition towards more knowledge-intensive activities (smart growth) and in contributing to the overall economic growth objectives and more and better jobs. But which kind of companies should be helped by policy? And how? This paper presents a literature review on the economics of research, innovation and competitiveness, focusing on the evidence available regarding the determinants for company creation and growth and the role played by Research, Development (R&D) and innovation. Furthermore, based on this, it draws a number of policy implications to design future research and innovation support instruments targeting innovative company growth in Europe.

The result of this work indicates that: a) EU needs support policies to foster R&D investment in some specific typology of innovative companies and only where there are market failures and clear high social returns; b) the establishment of any targeted support instruments should take into account an integrated set of criteria including: firms' age and size, the sectors where firms operate, the involved risks in and potential for their innovative and commercial activities, the country/techno-economic environment, and the degree of internationalisation; c) to be successful, no matter the new targeted policies and supporting instruments, they should be designed using policy experimentation and its results should be regularly measured and evaluated using appropriate indicators and analyses.

JEL Classification: O31, L25; R38

Keywords: Firm demographics and growth, Small and Medium Enterprises, economic dynamics, corporate research and innovation, EU competitiveness, EU policy.

1 Introduction

The new European research and innovation policy agenda emphasises the need to favour a positive dynamism of the demographics of EU innovative companies, especially SMEs, in new/knowledge-intensive industries. This is mainly due to their potential to shape the dynamism of the economy's sectoral composition, improve its whole competitiveness, and create more and better jobs. In fact, the EU is actually falling behind in terms of competitiveness due to insufficient SMEs innovativeness and strong obstacles on their sustainable growth path: Research and Innovation (R&I) policy plays a key role at this regard.

According to the EU Competitiveness Council, recalling the conclusions of the 2nd European Conference on Corporate R&D (EC, 2010d)[1], Europe needs 'an integrated approach of R&D&I policies by removing barriers to the restructuring of EU industry towards sectors with growth potential and to the growth of young innovative firms into tomorrow's global players'[2]. The European Commission's subsequent proposal of using the share of fast-growing innovative companies in the economy as the headline innovation indicator (complementing the already existing 3% R&D intensity target) illustrates well this new policy endeavour.

But the immediate questions that arise when devising concrete policies and instruments aiming at favouring the creation and growth of new and existing innovative companies in Europe are: Which companies are we concerned with? And more importantly: How do we support such companies? What are the most relevant factors that today underpin the firm's growth in such a rapidly evolving and globalised business world, which compete in/through science and technology?

In order to help answer these questions, this paper presents a thorough review of the recent economic and policy literature on the dynamics of industrial structures and the growth of SMEs and innovative companies. This includes the results of recent analyses implemented by JRC-IPTS on this subject, providing new insights on why firms' size, age, and the dynamics of the economic structures are important in explaining the overall EU knowledge intensity deficit. It also describes the role of firms' size with regards the innovation and economic performance of an economy. Based on this empirical background the paper aims to draw relevant policy implications for the implementation of the new research and innovation agenda, identifying in particular the main criteria to be applied when defining the scope of new supporting instruments targeting innovative firm growth. It also seeks to identify areas where more analysis and research is needed and to offer some conclusions in terms of how these policies could be designed and evaluated in the future.

Accordingly, the paper is structured as follows: after this introduction, the first section presents relevant information on the matter from the literature. The second section analyses the implication for policy and suggests R&I policy strategy and means, and proposes areas whereas there is a need to broaden present knowledge. A final section provides some concluding remarks.

[1] Whereas it applies across the document, the sign '■' indicates the work implemented by JRC-IPTS in the framework of IRMA activities, a JRC and DGRTD joint initiative.

[2] Council of the European Union (2010). *Creating an innovative Europe*. Conclusions of 3016th Competitiveness Council meeting. Brussels, 17 May 2010.

2 Dynamics of industrial structure and firms' growth: What do we know from the literature?

2.1 The dynamics of the EU economic structure and its technology specialisation

Europe has a quite static economic structure: the contribution of the high and medium-high tech manufacturing sectors to value added in the EU has hardly changed in the past decades (Moncada-Paternò-Castello, 2010). The composition of the manufacturing sector in terms of value added has hardly changed over the years. In 2003, the EU's manufacturing sector's composition is strikingly similar to that of 1979, i.e. 32% in the low, 26% in the medium-low, 37% in the medium-high, and 5% in the high R&D intensive sectors.[3] On the other hand, the US economy shows more dynamism and the share of the medium-low R&D intensive sectors has decreased between 1979 and 2003 from 27% to 21% in favour of the medium-high (34% to 37%) and high (7% to 9%) sectors.

Europe has a low level of specialisation in R&D-intensive activities. According to the European Commission (2010a), US corporate R&D growth is dominated by the high-tech sector, while that of the EU is spread across all sectors. Furthermore, between 2005 and 2008 the US has reinforced its corporate R&D investment in the high R&D-intensity sectors, while the EU has strengthened the medium ones. These findings are confirmed by other authors, as for instance Mowery (2009), who demonstrates that the US industrial R&D's structure has considerably changed over a period of 30 years.

In Europe, the industrial structure has changed at a more modest pace, as has been documented in the literature (e.g. Gambardella et al., 2007; Foray and Lhuillery, 2010). On the other hand, in the last two decades the greatest structural changes in industrial R&D have occurred in a set of new industries and services in the US and Japan. These countries are clearly more specialised than others in the world, but also more able to shift, maintain and reinforce their specialisation over time (European Commission, 2010b).

2.2 Firms' demographics and dynamics

Firms in the EU, especially smaller ones, exhibit a reduced ability of growing beyond certain size thresholds (especially when entering in new, knowledge-intensive sectors and sustaining growth). Such firms' dynamism, in turn, fostered by the industrial structure dynamics, is relevant for the quality and competitiveness of the given business sector, and therefore for the European economy and society.[4]

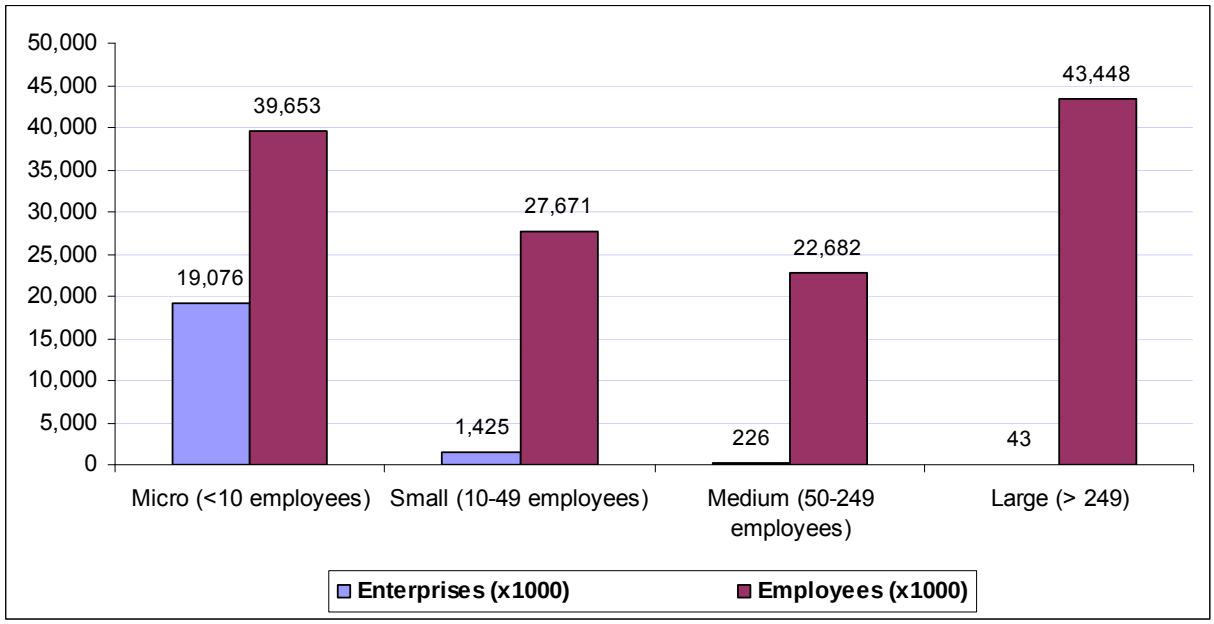
There are over 20 million enterprises in the European Union; the great majority (99.8 %) of these are SMEs (<250 employees). Almost 92% of the total number of enterprises are micro-sized (<10 employees), while 6.9% are small (<50 employees) and medium-sized enterprises (50-250 employees) only 1.1% (reference year: 2008; source Eurostat – see also Box 1 in the

[3] The taxonomy concerning sector's average R&D intensity (as ratio of R&D investment to net sales) follows the OECD definition (1986), i.e.: High R&D intensity sectors: higher than 5%; Medium-high R&D intensity: between 2% and 5%; Medium-low R&D intensity: between 1% and 2%; Low R&D intensity: below 1%. Similarly, such taxonomy is also applied for defining High, Medium-High, Medium-Low and Low-Tech firms.

[4] For an extensive literature review on firms' dynamics and economic competitiveness, see Bosma and Levie, 2010; Teruel and de Wit, 2011.

Annex). Figure 1 below reports the number of firms and employees by firms' size in the EU-27 for the non-financial business economy in 2008.

Figure 1. Firms' demographics in the EU-27 (2008)



Source: Elaboration from European Commission, DG ENTR – The Annual EU-SME Report 2008

When comparing the EU firms' demographics with that of major competing economies, it can be noted that the US holds relatively more micro-, medium-sized and large firms, while the EU has comparatively more small firms. The pattern for the US reflects a relatively small entry size in combination with strong competition among entrants, and where a minority of highly competitive new firms grow very fast: 75% of large firms founded since 1980 in the US have grown from small beginnings. By contrast, 80% of similarly-aged large firms in Europe are the result of mergers and acquisitions (EARTO et al., 2005). In Japan, there is an inversed pattern: entry size is larger, but the number of start-ups and fast-growing firms is low (European Commission, 2010c). On the other hand, Cunningham (2011) provides evidence that one of the most remarkable changes during the entire economic and enterprise reforms of China since 1978 has been the rapid growth of SMEs which has dramatically altered the structure and dynamics of the Chinese economy.

On average, during the period 2001-2006, 1.8 million new enterprises were established every year in the EU, corresponding to 9.7% of the total enterprise population. At the same time, 1.5 million enterprises annually cease to exist, corresponding to a death rate of 8.3 % of the enterprise stock (European Commission, 2010c). According to the analysis accompanying the EU's Small Business Act (European Commission, 2008a), entry rates are similar across the EU and the US. However, according to Cincera and Galgan (2005) the new firm entry appears to be easier in the US, and exit rates by incumbents are lower, giving successful SMEs less room to grow. This confirms that the drawback is not due to an absence of small firms that stay small and constitute the vast majority, but the surviving firms' insufficient ability to grow (O'Mahony and Van Ark, 2003; Cohen and Lorenzi, 2005). According to the EC (2007), 22% of the US companies which are now in the world's top 1000 in terms of market capitalisation, were created after 1980, compared with only 5% of their European counterparts. And of those US companies, 70% are IT companies.

SMEs account for a large proportion of value added and employment in all economies. In the EU, SMEs contributed with 58% to total value added in 2009 (EIM Business and Policy

Research, 2010). SMEs hold 81.3% of total employees in the EU (around 110 million jobs). According to Brinkley, (2008) much of the employment growth among SMEs over the past decade has been disproportionately concentrated in the knowledge intensive service industries. In OECD countries, SMEs are responsible for between 60%-70% of net job creation. In terms of job growth SMEs significantly outperformed large scale enterprises in 2002-2008. On the other hand, large scale enterprises outperform SME in labour productivity increases (Balkenhol, 2011).

Haltiwanger et al. (2010) confirmed that the net growth rates tend to be higher for smaller businesses in the US. More importantly, once they controlled for firm age, they found that the negative relationship between firm size and net growth disappears: i.e.: young firms grow more rapidly than their mature counterparts. This study' findings also highlight the following: i) business start-ups have an important role in job creation dynamics (small share of the job creation stock, but large relative share to the net job creation flow – 2.2% per year); ii) young firms exhibit high rates of gross job creation and destruction (after five years about 40% of the jobs initially created have been eliminated due to firm exit); iii) large and mature businesses account for a large fraction of total employment, as well as of job creation and destruction.[5]

In a recent EC/JRC-IPTS Workshop (2010e), Dr Hölzl introduced the result of his investigations[6] which analysed the characteristics of 'fast-growing firms' (firms with an annual growth of >20% over a period of 3 years) and their role in creating employment. He proved that Europe has less *'*new high-technology firms*'* and lower firm dynamics (post-entry growth). Such research showed that fast growing firms are rare in Europe – i.e. their share is hardly more than 5% of all surviving firms with more than ten years – and tending to be of temporary status, but their contribution to job creation is important. Such firms are small (but not over-proportionally), are not necessarily young (but over-proportionally young firms), and express market dynamism (in fact, the industry share of high growth firms is correlated with the industry share of fast declining firms). As far as the sectoral composition is concerned, a larger share of those firms emerged in real estate, business services and transport, storage and communications, and surprisingly (probably due to the deregulation in these network utility service sectors) in electricity, gas, and water supply. The data show significant country differences among the most advanced EU Member States.

2.3 Firms' demographics and R&D

Smaller and young EU firms are less represented among leading innovators than similar firms in competing economies. R&D is a relevant driver for growth only for a particular type of SME.

The literature concerning the impact of firm size on innovation activity reports mixed evidence. Studies on the subject have provided support to Schumpeterian hypothesis (Schumpeter, 1942) of a more than proportionate effect of firm size on innovative activity. This is the case, for example, of Pagano and Schivardi (2001) who show that a larger average firm size is associated with faster innovation rates within Europe. On the contrary, other studies (e.g. Acs and Audretsch, 1987) find that small firms have higher innovation rates in 'high technology', skill-intensive industries within the United States. Overall (across countries and sectors), there seems to be a convergence on the fact that that innovative output tends to rise less proportionally with firm size.[7]

Turning to what empirical evidence tells us in terms of firms size and R&D levels in aggregate terms, and focusing to 'R&D as innovation input', figures show that the share of business R&D

[5] Firms over ten years old and with more than five thousand workers account for about 45% of all jobs in the US's private sector. In turn, these large and mature firms account for almost 40% of job creation and destruction.

[6] See for example Hölzl and Friesenbicheler, 2010; Coad and Hölzl, 2010.

[7] For an extended literature review on the subject, see Syrneonidis, 1996; Teruel and de Wit, 2011.

performed by SMEs in the EU (33.4%[8]) is substantially higher than in the US (15%)[9]. However, when we compare the absolute amounts of R&D invested by SMEs in the EU and the US, figures show an immense difference in favour of the US group: they invest around 7-8 times more (Muldur, 2001). Given that 'individually' and 'sector-by-sector' the average R&D intensity of EU SMEs is comparable with that of their US counterparts, the origin of this gap comes from a difference in the sectoral composition of the SMEs populations: relatively fewer EU SMEs are found in high-R&D intensity sectors compared to the US (European Commission, 2007; Ortega-Argilés et al., 2009a)[10].

This has led some to believe that SMEs in Europe (which are numerous, yet operating in sectors with a lower R&D intensity[11]) have a high potential for reducing the R&D intensity gap. However, considering that the vast majority of enterprises in the EU are SMEs, and only 3% of them are engaging in research (Potočnik, 2009), even if the current SMEs were to double their R&D investment, it is not likely to have a significant impact on private-sector R&D intensity in the EU over a short time (Moncada-Paternò-Castello et al., 2010).

Given the structural origin of this R&D investment gap,the EU needs to enjoy the presence of more and growing SMEs in the R&D intensive sectors of the economy. This would require, apart from the growth of existing firms operating in these sectors, an increase in the number of successful (ideally high-growing) start-ups, able to become global players in a relatively short time. While the benefits of increasing the number and size of European companies seems to be clear in terms of reducing the R&D investment gap, the direct relationship between an increase in the R&D levels invested by European SMEs and their growth, both in terms of turnover and profits and employment, and therefore in terms of overall impact on the overall performance of the economy, is less straightforward and needs to be further qualified. SMEs have the potential to affect the overall R&D intensity, particularly if R&D investment contributes significantly to their growth, as the empirical evidence demonstrates (Stam and Wennberg, 2009; Coad and Rao, 2010). However, it should be pointed out that the 'relevance of R&D's role' for SME growth can only clearly be stated to a limited extent: in terms of fast growing companies, only those that operate in close proximity to the technological frontier (being greater for those operating in countries that are more technologically developed); in terms of young firms, only to the new technology-based ones (Ortega-Argilés et al., 2009a). Even within this last case, the benefits of supporting R&D investment in newborn technology-based firms does not appear to be as important as the potential benefit of supporting already established SMEs to be able to grow fast (Stam and Wennberg, 2009).A recent analysis (Bogliacino, 2011) concerning the impact of R&D intensity increase on the job creation and the economy, concluded that the cause of the change in employment due to the change in R&D (elasticity) is not constant, neither with regard to the amount of R&D expended, nor the firm size. The study, in fact, detected a size effect, driven by more efficiency in the research conducted by large firms, but also a scale effect, i.e. a decreasing return to R&D expenditure. For a given R&D intensity, the latter tends to prevail, in such a way that for any increase in the market share by a firm, the R&D employment elasticity tends to increase.

There are other many aspects that influence innovative firm size. For example, in some sectors (e.g. ICT, software, biotechnology) there is an increasing R&D investment 'atomisation' by a large number of SMEs, which are very dynamic, creative and innovative.

[8] This is the average for 21 EU Member States, with large differences between them: from 9.8% in Germany to 59.7% in Greece.

[9] Source: own calculation from OECD, 2009

[10] Although about one third of EU business expenditure on R&D is carried out by firms with less than 500 employees, according to Moncada-Paternò-Castello et al. (2010) and Ortega-Argilés and Brandsma (2010), there are more US companies that are smaller R&D investors, compared to the EU. As such, the size of R&D intensive firms can explain the overall R&D intensity gap between the EU and the US. Such kind of US companies are concentrated in sectors that are intrinsically R&D-intensive, thus raising the US's overall R&D performance vis-à-vis the EU.

[11] See Muldur, 2001.

Large size enterprises (LSEs), which coexist with SMEs in these sectors, benefit directly or indirectly from the innovative output of such SMEs.

Overall, the available evidence confirms that the US is more able to renew its demographic of R&D-active companies than the EU. In addition to the literature and analysis already mentioned, a recent analysis by Cincera and Veugelers (2010), shows that: a) among the leading R&D investors (top R&D corporate investors present in the EU industrial R&D Scoreboard ranking), more than half (52%) of them are 'young' enterprises (i.e. established after 1975) in the US. By contrast, the EU has only one out of five (20%) 'young' leading R&D investors; b) that such young firms have a higher sales growth which is similar in the EU and the US; and c) that the lower R&D intensity of young EU firms is one of the most important factors responsible for the EU-US R&D intensity gap (see also Box 2 in the Annex).

According to the Community Innovation Survey (CIS, 2006), with regard to innovation output, a lower percentage of SMEs in the EU successfully innovate (introducing products and services) as compared to large firms. Moreover, the share of SMEs in total innovative turnover is much smaller than their share in total economic activities in most EU countries (European Commission, 2006a).

2.4 Non-R&D causes of firms' dynamics

Business dynamism is not necessarily determined by the R&D level (and innovation); it is more often determined by economic factors varying across market environments. Certainly EU firm growth is affected by its industry or sector growth. For example, the differences in the speed of growth of companies between EU Member States mentioned at the end of the previous section on firm demographics and dynamics might be due to differences in market size and industry growth. In fact, firms in industries with high entry of new firms grow more than firms in more stable industries (Breschi et al., 2000; Sciascia et al. 2009). However, the number of such dynamic new sectors or markets characterised by high growth rates and firm dynamics are less frequent in Europe than in other world regions. Besides, it should be recognised that it is difficult for a small enterprise to enter and do business in some specific sectors (e.g. commodities, like energy; chemicals), whereas other sectors (e.g. instruments) accommodate SMEs well. There are also some sectors which benefit from the co-existence of small and large companies (ICT, Software, biotech), as underlined by Veugelers (2008). Furthermore, Coad (2010) found that the age distribution of disaggregated industries is often not regular.

One important point to be made is that the importance of R&D investments for SMEs is not equal across all sectors. Evidence shows that investment in physical capital stock results in higher productivity returns in low-tech and service sectors than R&D investment - while R&D investment results in higher productivity returns in high-tech sectors (Ortega-Argiles et al., 2010). A recent study establishing a new EU-wide taxonomy of R&D-intensive SMEs (Ortega-Argilés et al., 2009b), finds that the biggest investors in R&D are not necessarily the fastest growing companies. It also finds that there is no common success pattern among R&D-intensive SMEs, concluding that their growth depends on many factors, in addition to R&D. Weinberger (2011) reports that 46% of innovating EU enterprises in the period 2006-2008 did so without R&D.

R&D has to be understood as a long-term investment, that for some firms appears to be the only relevant investment and for others is not a determinant.

Literature on determining factors for firms competitiveness and growth have identified a wide range of factors including, among others: types and costs of the R&D activities; funding sources; risk and technological opportunities; technology specificities; skills (incl. entrepreneurship); organisational innovation; access to human and financial capital and to external knowledge; economic competencies; business models and niche strategies. In addition, patterns vary for particular industries (sector specificity), periods or countries (see Box 3 in the Annex - an example on technological opportunities and investment in R&I

provided by Mr Pietrogrande at the EC, JRC-IPTS Workshop, 2010e). An extended recent literature review supports the above mentioned determining factors for business dynamics (e.g. Corrado, Hulten and Sichel, 2005; Santarelli and Vivarelli, 2007; van Bavel et al., 2010; Moncada-Paternò-Castello, 2011, Ciriaci and Garcia, 2011).

Furthermore, NESTA (2009) indicates that firm growth through mergers and acquisitions (with resulting increases in firm sizes and increases in market concentration) may in some cases contribute to aggregate growth by facilitating the scaling-up, diffusion and adoption of innovations created by small firms. However, evidence suggests that the expected benefits of this type of growth do not often materialise.

On the other hand, one phenomenon which is quite frequent in the EU is that successful SMEs are bought-out by large companies (or stay small), which highlights the difficulty which SMEs encounter to handle their expansion phase and become larger (European Capital Markets Institute, 2011).

In fact, each sector (industry) appears to have an optimal size (European Commission, 2011b) and this is the reason why SMEs are so important in many industries, such as ICT producers. The EU appeared to have a competitive advantage in more mature industries, belonging to manufacturing and ICT-users. These particular industries are characterised by a higher scale of operations. Therefore, the only way to succeed in the market is through mergers and acquisition processes.

Based on the above, evidence confirms that, in general, driving forces behind high firm growth are related to knowledge sources (including technology characteristics), institutional settings (e.g. regulation), specific market dynamics and opportunities (including a favourable business environment), and skills/entrepreneurship (Veugelers, 2008; Teruel and de Wit, 2011).

2.5 Firm size, EU competitiveness and growth

While economic theory since Solow (1957) points to technical change as the major source of productivity growth in the long run, there is widespread belief that the smallness of a company plays a significant role in the link between the economic structure and growth, and in general in the macroeconomic performance (Acs and Audretsch, 1987; Van Dijk et. al.,1997; Brouwer, 1998). Indeed, the smallness of R&D-intensive companies (SMEs) is crucial for the EU innovation and competitiveness; however, other types of firms are equally important in helping the EU prosper. Promoting employment and competitiveness in a knowledge economy can be achieved by addressing different firms' types. Not only new small innovative actors, with higher research intensity, which enter and grow rapidly, but also other firm types can be addressed (see Pagano and Schivardi, 2003; Hirsch-Kreinsen, 2008; Potters, 2009; Bogliacino 2010), such as:

- *Existing large companies operating in medium- and high-tech sectors.* Large average size enterprise fosters productivity growth because it makes taking advantage of all the increasing R&D investment-associated returns possible. In addition, large exporting firms have a role in technology absorption from abroad (Goldberg et al., 2008).

- *SMEs and large firms which operate in more EU* 'traditional'*, low-tech sectors,* and have a prominent technology absorptive capacity.[12] They are able to operate internationally, and show innovative management skills and have a high sustainable growth potential. Although, it should be noted that in such low- (and mid-) tech SMEs where technology absorption is the main growth channel, a certain level of R&D activity and experience is required to allow absorption or imitation (Griffith, Redding and Van Reenen, 2004). These low-tech firms, which are not necessarily less innovative, account for a high share of value added in the EU economy (about 32% of total value added of the whole manufacturing sector in 2003 - Potters, 2009). For this type of firms Ortega-Argilés et al. (2010) show that R&D investments appear to have a non-significant effect on labour productivity.

[12] The introduction and dissemination of ICTs in small scale firms appear an essential factor for increasing firm productivity, competitiveness and growth.

Coad and Hölzl (2010) conclude a review article by saying that 'the literature shows that high-growth firms are the central drivers of job creation in the economy but that these firms are neither clustered in high technology sectors nor are these firms necessarily young and small. The evidence on the determinants of firm growth confirms that firm growth is difficult to predict.'

In addition, it should be pointed out that the SMEs' future role on the overall economy will also depend on how globalisation affects size structure; there are factors working in both positive and negative directions (Moncada-Paternò-Castello et al., 2011).

All the evidence presented in this section on the dynamics of industrial structures and innovative company growth indicates that the EU shows the following, compared to main competing economies (notably the US):

- A fairly static economic structure that has hardly changed during recent decades.
- A low level of specialisation in high knowledge-intense sectors, and a high level of specialisation in medium knowledge-intense sectors.
- A lower firm's post-entry growth, and in general a reduced ability of firms to grow beyond certain size thresholds
- A limited number of young firms, and of new large firms.
- A higher share of absolute R&D expenditures preformed by SMEs, but in average the EU SMEs are far less R&D intensive as they tend to engage in less R&D intensive sectors (medium- and low-tech).
- A business dynamism which is not necessarily determined by the level of research and innovation (R&I), but often determined by economic factors varying across entrepreneurial and market environments.

Such findings largely support the rationale of policy interventions to promote the growth of innovative companies in Europe, but making it clear that:

- The focus of innovative companies should be broad enough to take into account more factors than just R&D (which is one determinant among other factors explaining growth), in particular for medium- and low-tech sectors, to the sphere of other innovation factors and to framework conditions (technological, economic and regulatory).
- Start-ups and young firms grow more rapidly than their mature counterparts, and that fast growth is limited in time in many cases. On the other hand, small and young firms are not necessarily more innovative than large established companies. Furthermore, company growth depends on company strategy and entrepreneur capacity and goals, bearing in mind that there is a model (optimal) company size in many sectors.
- The ultimate viable policy objective to reach should not always be for SMEs to grow into large companies, but rather to ensure a sufficient number of highly-innovative, dynamic[13] and competitive companies (whatever the size) in key sectors.
- An appropriate policy mix needs to also take into account a targeted approach, which is different depending on the age, size, sector, company characteristics. It must also depend on the country's technological and economic position.

The next section analyses the policy implications from this empirical evidence for the design and application of specific measures aiming at supporting the innovative company growth in Europe.

[13] It refers to their ability to grow but also to shift their technology base and product and service/sector of activities. The objective also includes a large share of SMEs, which are able to survive and become highly competitive.

3 Implication for policies: A case for new targeted measures

As acknowledged in the new research and innovation agenda (Innovation Union flagship) and the new industrial policy agenda for a globalised economy (European Commission, 2010g), there is an urgent need to establish long-term business sector policies in Europe, addressing framework condition improvements that are conducive of knowledge creation, transfer and diffusion. These policies[14] are crucial to promote higher levels of business R&D investments and improve companies' innovation performance, and to ultimately contribute to improving the overall performance of the European economy.

The radical improvement of the framework conditions, in fact, is probably the most important strategic policy undertaking to support the growth of innovative firms where there are market or system failures and at the same time clear high social returns. The main topics of framework conditions identified as meriting a priority attention by policy-makers are a) skills upgrading, b) common and better access to markets, and knowledge' suppliers and users, c) access to financial capital, and d) entrepreneurial innovation culture and economy. These topics are discussed in the Annex (Box 4).

Although recognising that the framework conditions plays a pivotal role on firms' growth, this chapter mainly discusses the opportunity, focus and possible new means for targeted policy in support of firm growth and competitiveness though innovation as one important strand of the policy mix.

3.1 What's the rationale for targeted policy interventions?

As is amply supported by the literature, not all firm types face similar market imperfections as their specificities in sizes, in age, as well as in sectors and countries where they operate, differ quite substantially. It is therefore inefficient to only address with a general purpose policy the market imperfections encountered by companies which aim to grow and be more competitive. Nor is it always clear to what extent public intervention should target specific sectors, technologies, or firm size and age when designing R&D and innovation support instruments. Nonetheless, we are convinced that policies which address particular sectors and subgroups of companies are justified; particularly those which tackle major societal challenges (e.g. aging society, climate change, energy supply, safety and security) and only when there are relevant market/system failures (e.g. difficult access to capital, knowledge and infrastructures), and possibly intervene only for a limited period of time. In any case, targeting specific sectors is always difficult due to the uncertainties of ex ante choices, and specific company selection should avoid picking-up winners (Cawley and Hölzl; at the European Commission/JRC-IPTS Workshop, 2010e).

3.2 Which companies should be supported?

As the evidence supports, not all small firms should be helped because of their size (e.g. focus on SMEs only) and supporting R&D activities will not always help them grow more or faster. According to recent literature (Meza and Tombak, 2009; Matsumura and Matsushima, 2010) helping the small inefficient firms reduces social welfare, and therefore, consumer surplus. In effect, according to these recent studies, small firms seem to have their own

[14] As an example, the establishment of the Europe's Small Business Act in 2008 (European Commission, 2008a) is one important milestone in this area. It aims at the improvement of the overall approach to entrepreneurship to promote SMEs' growth by helping them tackle the problems which hamper their development.

strategic incentive to invest in R&D because, despite the more moderated economies of scale in R&D activities, it causes higher returns (i.e. profits) in more efficient small firms than in large efficient firms.

In addition, we have seen that R&D is a relevant growth driver only for particular types of SMEs and in particular sectors and economic environments. For example, private-sector R&D investment is most effective in raising productivity in sectors where R&D intensity is high and in large R&D firms, whereas technological change embodied in the physical capital stock is crucial for productivity increases in low-tech and services sectors.[15] These results, lead to the conclusion that there could be some R&D investment strategies and policies that are more effective than others as for example a differentiated R&D policy approach by activity sector according to their R&D intensity, firm size and business phase (Moncada-Paternò-Castello, 2010a).

Promoting R&D investments and company dynamics (creation and growth) in new high-innovative/high-tech sectors is important to boost economy-wide employment and growth but not enough. As the evidence presented in Section 1 shows, large companies and SMEs operating in medium- or low-tech sectors have a great innovation potential, mainly through the absorption of new technology and through the creation and dissemination of non-technological innovation. Therefore, policies should strike the right balance between the need to shift industrial structures towards new and high technological sectors and the need to modernise mature and traditional sectors.

As a matter of fact, a new targeted support policy at firm level for innovative companies aiming at making them grow should consider all together factors such as: the age (not necessarily only the youngest enterprises!), the size (not always the smallest!), the involved risks and potential for their innovative and commercial activities, their business cycle and phase, the country/techno-economic environment, and their internationalisation potential. Taking inspiration from the definition of young innovative enterprises in the EU State Aid Rules (European Commission, 2006b), a sort of multi-criteria 'identification index'[16] could be considered by policy makers to spot groups of companies which need support to grow (the values of factors determining the index could be adapted according to the policy objectives of the given country/region). It would be based on the following combined criteria:

- **Size.** In general, growth rates tend to be higher for smaller firms.
- **Age.** As seen, age seems to matter as a factor to explain innovation and growth.
- **Innovativeness**. It should be measured not just in terms of R&D intensity level (compared to sector average) for a number of years, but also in terms of the companies' ability to launch new or substantially improved products on the market.[17]
- **Sector.** Where the company operates (e.g. by its technology intensity).[18]
- **Business phase.** E.g., start-up, expansion or maturity phase.[19]

[15] Productivity improvements in the service sector is the key for generating jobs as such sectors are accountable for all net job growth in developed economies (McKinsey, 2010).

[16] A synthetic evaluation index can be elaborated allowing qualitative and quantitative evaluation inputs to be combined. As a methodological example, see Moncada-Paternò-Castello et al. (2003 and 2000).

[17] Any indicator or indicators' group selected to measure the degree of 'innovativeness' of the companies should not only capture both input (e.g. R&D investments) and output (e.g. new products launched) factors but should also take into account the degree of technological and commercial risk of its innovation activities. In this respect, reward to risk-taking and reward to the commercial exploitation potential of R&D and innovation planned activities should be considered (often more than the scientific excellence expected).

[18] As seen, for example, investment in physical capital stock results in higher productivity returns in low-tech and service sectors than R&D investment; while R&D investment results in higher productivity returns in high-tech sectors (Ortega-Argiles et al., 2009).

[19] For example, as mentioned before, R&D investment support in newborn New technology-Based Firms (NTBF) is not as critical as it is in established SMEs to be able to grow fast (Stam and Wennberg, 2009).

- **Country's techno-economic characteristics**. For example, public support to innovation on SMEs established/operating in developed countries that are at the technological frontier or have an appreciable R&I specialisation/basis should be handled differently to developing economies that are still far from the technological frontier or do not benefit from a sound R&I specialisation/basis[20].
- **Internationalisation** (actual/potential). For example, evidence suggests that internationalisation strategies appear to have a direct effect on SME growth, survival and competitiveness[21] (European Commission, 2010f).

In sum, it is argued that a renewed, differentiated EU R&I policy would need not only focus on young innovative and fast-growing firms operating in high-tech sectors but also cover high-growth companies' potential, operating in less R&D intensive sectors with perspectives to become and stay large enterprises in a short- or medium-term thanks to innovation. The use[22] of such differentiation approach should be adequately calibrated, previously tested and efficiently managed to avoid any possible drawbacks.

3.3 How should these companies be helped?

In order to tackle different groups of innovative companies, as described above, it may be advisable to undertake a policy which combines measures for stimulating corporate R&I investment in medium- and high-tech sectors, while implementing incentive schemes to reinforce the capacity absorption of its results in low-tech sectors, and supporting firm formation and growth. In doing so, measures favouring an efficient market for technologies and easier access to tailored financial resources and internationalisation activities should be considered.

Policy measures to stimulate corporate R&D and innovation activities in these two differentiated groups of companies would be tailored according to the following lines, for example:

- Support for high R&D-intensive sectors, would imply measures such as temporary tax incentives, fostering participation to public R&D support programmes and setting up international cooperation agreements.
- Support for low R&D-intensive sectors would include measures aiming at stimulating capital investment in innovation by offering companies better and more targeted financial measures, including stimulating bank investments, injection of public funds in risk capital formation, and alternative stock markets (Moncada-Paternò-Castello, 2010).

In addition, targeted support to innovative company growth through research and innovation shall include measures that favour:

[20] Research indicates, in fact, that large exporting firms are typically the primary mechanism through which technologies are adapted from abroad to local circumstances in developing countries. Thus, from a developing economy perspective, the firm-level evidence does not favour SMEs subsidisation as a mechanism for boosting short-term innovation and productivity growth (Ross, 2005). On the other hand, Saublens and Walburn (2009) suggest that policy interventions should already be in successful regions if the objective is to boost small business performance in aggregate.

[21] International SMEs create more jobs: Internationally-active SMEs report an employment growth of 7% versus only 1% for SMEs without any international activities. Furthermore, international SMEs are more innovative: 26% of internationally-active SMEs introduced products or services that were new for their sector in their country; for other SMEs this is only 8%. However, public support goes largely unnoticed: only 16% of SMEs are aware of public support programmes for internationalisation and only a small number of SMEs use public support.

[22] For example, the 'identification index' can first be calibrated according to the policy measure objective in a given region, and then used to identify group(s) of companies that are candidates to be policy intervention beneficiaries.

- Activity internationalisation, especially in SMEs (e.g. by providing financial incentives and aid, such as grants for commercialising products, as well as financial and insurance support, and export consortia support).
- Cluster development, (e.g. support mechanism for SMEs, favouring knowledge transfer partnerships as a primary method of improving SME cluster effectiveness).
- Intellectual property protection (e.g. lowering IP costs).
- Innovation management improvement (e.g. training).

Participants at the EC/JRC-IPTS Workshop suggested other specific policy examples to foster innovative SME growth (2010e)[■]:

- Establish a pan-European Venture Capital fund for innovative SMEs in sectors relevant to the EU 'Grand Challenges'.
- Urgently implement the recommendations issued from the recent revision of the Risk Sharing Financial Facility for innovative SMEs.
- Establish targeted instruments, such as Small Business Innovation Research (SBIR) type support programmes at EU level, and also focus new EU-targeted instruments on the use of public procurement as leverage of SME innovation.
- Fully exploit the possibilities offered by current State Aid Framework rules for R&D and innovation support and the future 'Common Strategic Framework for EU Research and Innovation funding'.[23]
- Provide privileged access to public procurement, public-private risk share of venture capital and financial credits/credit guarantees.

Examples for both SMEs and Large Size Enterprises (LSEs) growth though research and innovation are: reform for financial credit access, using electronic invoicing, European-wise product and service standards.

In any case, such actions would need to be pushed jointly by Member States and the EU and their policy instruments should seek synergies and their implementation be co-ordinated.

3.4 New Policy experimentation and evaluation based on new data and related policy-relevant analyses

Recognising that providing differentiated and targeted support to innovative company growth is a complex (and sometimes controversial) undertaking, future policy measures in this domain should be designed so that new public objectives and business approaches are addressed (e.g. internationalisation, open innovation, mass customisation).

A modern and innovative policy design is required, in which new policy measures are tested prior to being launched and then systematically subject to monitoring and evaluation mechanisms. They then may be subject to termination, or related policies be redirected, if testing is not efficient, or if the marked conditions that justified the intervention change.

For example, as age seems to be a factor that explains firm survival, innovation and growth, the convenience of targeting specific companies and/or sectors using age rather than size or both age and size as an eligibility factor should be evaluated for possible support instruments, and be eventually tested. Another example is the elaboration of policies addressing particular subgroups of companies, which reconcile present rules and norms, limiting the adoption of such kind of policies by Member States.

Some recent studies discuss the effectiveness of subsidies, for example, Schneider and Veugelers (2010) in Germany suggest that subsidy allocation mechanisms in place are not associated with the young innovative companies being relatively higher innovative performers.

[23] On 9th February 2011, the European Commission presented a Green Paper on the subject which proposes major changes to EU research and innovation funding. The changes, to be introduced in the next EU budget after 2013, would bring together the current Framework Programme for Research and Technological Development, the Competitiveness and Innovation Programme, and the European Institute of Innovation and Technology.

To monitor and evaluate effectiveness of the policy measures and the achievement of new policy objectives, policy-making should rely on adequate (new) data and analyses. Unfortunately, data (statistical and stakeholder-based) and databases at firm level that fully facilitate EU-level monitoring and analysis of business and innovation activity and their growth (e.g. SMEs), taking into account the factors determining such growth (including firm, sector and country/region effects) are very scarce, and are often not appropriate (scattered, incomplete, not representative).

There are some interesting national-based examples as well as cross-border initiatives that represent a good basis and can prospect a better future for data availability. These include the European Commission, OECD as well as organisations in some Member States (e.g. the UK, Ireland, Sweden, Spain, The Netherlands, Austria and Germany). Hopefully, the urgency to monitor such relevant phenomena for the EU economy's competitiveness and growth will result in efficient undertaking and fruitful coordination between the interested parties.

From the above, analyses relevant for policy makers should not only address young and fast-growing (innovative) firms in high-tech sectors. Future evidence gathering (at firm level), research and analysis should also focus on issues like the following:

a) Companies' ability to absorb new technologies (including ICTs) as an important innovation and growth factor, particularly for low R&D-intensive sectors and for smaller companies.

b) Young or old medium-sized firms' growth (e.g. 5%-10% growth during the last 5-10 years), to see if they have a rapid (especially for young SMEs) or constant and sustained (for older SMEs) growth and if it is linked to R&D and/or innovation activities, and which other business/economic/financial factors may have contributed to the observed growth behaviour. In addition, by monitoring growth across firms (micro- to medium-sized) and sectors, such investigation may contribute to detect (actual/potential) new and growing firms and sectors.

c) Companies' and sectors' degree of innovation considering investments on the broad range of intangible assets related to strengthening and using companies' knowledge capital, including their workers' education and skill levels.

These are examples of issues for further investigation that are being implemented or considered by the JRC-IPTS. Such and other relevant issues on the subject will be presented and discussed by stakeholders at the upcoming 3rd European Conference on Corporate R&D and Innovation (CONCORD 2011 – JRC-IPTS, Seville, 6 October 2011) which will focus on the 'Dynamics of the economy and the growth innovative firms in the EU'.

Table 1 provides some examples of policy actions which support SME growth through R&D and innovation.

Table 1. Examples of policy actions to support SME growth through R&I

<table>
<tr><td rowspan="4">Framework conditions / Horizontal support</td><td>Upgrading skills</td><td colspan="2">• Education and training</td></tr>
<tr><td>Better access to markets and knowledge</td><td colspan="2">• Incubation
• Clustering and cooperation
• Internationalisation
• Lead new market initiative
• Tax incentives, state aids, public procurements
• Standardisation, regulation and certification, IPR policy
• Internal market, trade and competition</td></tr>
<tr><td>Improve access to financial and human capital</td><td colspan="2">• Risk venture capital
• Loan guarantees
• Mobility programmes</td></tr>
<tr><td>Promote innovation & entrepreneurial culture & economy</td><td colspan="2">• Entrepreneurial culture
• Foster 'EU Research & Innovation Society' development</td></tr>
<tr><td rowspan="3">Targeted policy actions</td><td></td><td>SMEs operating in high- and medium-high tech sectors</td><td>SMEs operating in medium-low and low-tech sectors</td></tr>
<tr><td>Support to R&D investment in SMEs for their competitiveness and growth</td><td>Providing temporary tax incentives, fostering participation in public R&D support programmes, and risk-sharing loans for R&D activities focused on EU societal challenges</td><td>Supporting new cooperation agreements with external R&D sources.
Increasing internal absorptive capacity</td></tr>
<tr><td>Support to Innovation investment in SMEs for their competitiveness and growth</td><td>Action Financial support to later-stage high-tech innovation funding through grants combined with equity finance to facilitate subsequent commercial funding</td><td>Actions aimed at stimulating capital expenditure in innovation by offering companies better and more targeted financial measures, including stimulating bank investments, injection of public funds in risk capital formation, and alternative stock markets</td></tr>
<tr><td>Policy experimentation and evaluation</td><td colspan="3">Experimentation
Implementing an experimental test for targeted policies, meaning that R&I-led SME growth would privilege those firms that present a high appraisal score of a multi-attribute ‘identification index’. This combines values of young-age, capability of developing or absorbing technologically-new or substantially-improved products and processes, which carry a risk of scientific, technological or commercial failure, or have a high R&D intensity (compared to sector average) for a number of years, appreciation of sector characteristics, business phase (e.g., start-up, expansion or maturity phase), internationalisation potential, and techno-economic/market environment.

Evaluation
Assessing effectiveness of the above-mentioned experimental test</td></tr>
</table>

Source: own elaboration

4 Concluding remarks

Changes in the technological process direction along with changes in the world economy resulted in a structural shift affecting all industrialised countries' economies, and since the 1970s, resulted in the downfall of mass production, the promotion of flexible specialisation and in small(er) firms playing a more important role. In some sectors (e.g. biotech), SMEs are able to create new and abundant knowledge and innovative solutions, and supply them to large size enterprises (LSEs) - in a synergic coexistence - and remain healthily competitive for many years even if they do not become LSEs. This is a new business model where SMEs take advantage of their small size and high dynamism, for example, by rapidly establishing or shifting their R&D infrastructure, spurring knowledge creation and advances, relying on a new open innovation system. This is also why we cannot expect that a large proportion of SMEs, which are almost the totality (99.8%) of all firms in EU, become innovative LSEs. Instead, we should aim at observing that both SMEs and LSEs in the EU become more competitive by producing and absorbing more S&T/I to create higher value added and generate new and better jobs. Such purpose, of course, also includes more young SMEs which become LSEs in new knowledge-intensive sectors. This should imply a more dynamic 'creative-destruction' business demography and increase firms' capacity to create and access knowledge and markets (technology, labour, financial, consumer).

The recent literature and JRC-IPTS studies indicate that R&D is one of most important investments that affect firm growth, firm productivity and firm survival and for them to contribute to EU innovation and competitiveness, although R&D is not the most important investment for some particular firms and sectors. In fact, there are also other economic factors that determine the innovative company growth (e.g. other intangibles) which in turn are very much dependent on firm, technological, sector and socio-economic/market environment characteristics. Furthermore, complementarities among investments (R&D, human capital, ICTs, physical capital, internationalisation) are more important than a firm solely devoting its resources to one of these investments.

One of the main final objectives for public intervention in Europe in research, innovation and industrial policies should be to increase European innovative company growth. In this respect, recent literature and JRC-IPTS research indicates that the attention paid to the growth of innovative companies, as announced by the Commission's Innovation Union initiative, following the 'Europe 2020 Strategy', is going in the right direction. To translate the EU policy agenda into effective policy actions, the result of this study indicates that EU support policies need to foster R&D investment in a specific innovative company type, and only where there are market failures and clear high social returns (e.g. supporting EU 'Grand Challenge' achievement).

With this aim it is suggested that future EU support instrument design take a targeted approach, based on an 'identification index' which takes into account several factors including: age, size, innovativeness (not just measured in terms of R&D intensity but also including the capacity to absorb technological progress and other means of non-technological innovation), activity sector, location, business cycle, and internationalisation potential. It is in fact important for policy-makers to know what targeted group of companies is to be addressed. In addition, policy experimentation and evaluation based on new data and related policy-relevant analyses should be at the core of policy design and implementation in this area.

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Annex

Box 1. Firm demographics in the EU-27 (non-financial business economy, 2008)

	Enterprises (1,000)	Employees (1,000)	Labour productivity (1,000)
Micro- (<10 employees)	19,076 (91.8%)	39,653 (30%)	33
Small- (10-49 employee)	1,425 (6.9%)	27,671 (21%)	43
Medium- (50-249 employees)	226 (1.1%)	22,682 (17%)	50
Total SMEs	***20,727 (99.8%)***	***90,006 (67%)***	***40***
Large-Sized Enterprises (LSEs)	***43 (0.2%)***	***43,448 (33%)***	***61***
TOTAL	20,771 (100%)	133,455 (100%)	47

Source: European Commission, DG ENTR – The Annual EU-SME Report 2008

Box 2. The EU R&D intensity gap and firm competitiveness

Whether it is the under-investment in R&D or the sectoral composition of the economy, the prevailing factor for the R&D intensity gap between the EU and the competing world regions and countries, has been largely studied but outcomes are discrepant. Some authors assert that the intrinsic effect (under-investment) dominates the phenomenon (Dosi, Verspagen, 2010; Erken and van Es, 2007; ETEPS, 2007; Pianta, 2005; van Reenen, 1997), others indicate that the structural effect (i.e. sectoral composition) is the cause (Moncada-Paternò-Castello et al., 2010; Cincera and Veugelers, 2010; Mathieu and Van Pottelsberge de la Potterie, 2008; Van Ark et al., 2003; Pavitt and Soete, 1982), and other studies show that both effects can be present in a given economy (Van der Zwan, JRC-IPTS Workshop, 2010e). Although there are such different results, we are convinced that comparable companies, especially those which operate globally, compete to maintain their leading positions using a bunch of different means which can vary from R&D and innovation, to labour and/or operation and maintenance improvement/costs reduction. It is more likely that these companies use a combination of these means, in similar or different degrees of magnitude, depending on the company leadership and strategy, state of technology development, and market/region features (see also Box 3 below for an example).

Box 3. Technological opportunity and R&I intensity – The photovoltaic industry case

Industry characteristics, such as technological opportunity, may better explain the variance of R&D intensity or innovation than market structure or firm size. Companies are driven by market share and product performance to get premium pricing as drivers for a firm's growth. Relevant success elements are time-to-market and early product development and credibility.

The photovoltaic (PV) energy industry gives an illustrative example. According to Mr Pietrogrande (former CEO of 9REN), EU Member States have heavily incentivised power plant construction, but have not given European component manufacturers enough pre-emption time to develop, though significant R&I investments, advanced products and efficient manufacturing processes. As such, most of the incentivised plants have actually benefited non-EU manufacturers. €55bn has been spent on building solar power plants in Europe over the last 6 years, although 78% of global expenditures have resulted in only 35% market share for EU components and products. Of the €30bn invested in 2009 on photovoltaic power systems in the EU, an estimated 43% resulted in actual energy or local employment benefit, while 57% funded photovoltaic manufacturers, two third of which were foreign (Pietrogrande; EC, JRC-IPTS Workshop, 2010e).

Box 4. Improvement of framework conditions

A selection of relevant issues for the EU policies concerning the framework conditions supporting innovative company growth is proposed in following sections.

A. *Upgrading skills.* Skill mismatches in the labour market have been a growing concern in most EU Member States. The EU does not only need more researchers, but also needs to upgrade its present skills.[24] Due to imperfect information and structural rigidities, workers and businesses are not provided with the right level of skills in the right areas, which damages competitiveness, especially for smaller enterprises. The composition of skills emerging from EU universities and training systems does not fully support a truly innovation-driven economy (European Commission, 2008b). The scarce availability of specialised labour forces could represent an obstacle for the growth of all company sizes, but much more for SMEs.[25] In fact, there are still fewer researchers in the EU labour force, notably in private sector compared with their peers in competing economies (e.g. 0.51% in the EU and 0.93% in Japan in 2006 – source EC, Eurostat, 2011). A very recent OECD study (2011) confirms that there is a correlation between R&D staffing levels and in-house product innovation in industrial research. Therefore, training to acquire or improve skills in entrepreneurship, in science and technology (S&T), in S&T together with technology-based business management, organisational innovation, should be a firm long-term policy priority.
Since labour market rigidities allied to under-investment in education and skills have been key reasons for the EU's persistent under-performance, the British Chambers of Commerce (2010) suggests that it is absolutely critical to achieve a significant structural reform to Europe's labour markets and education policies. In particular, this means improving flexibility and mobility across Europe, and securing major improvements in skills and productivity.

B. *Common and better access to markets, and knowledge suppliers and users*
Policy should aim at favouring an open and global access to markets and knowledge suppliers and users for goods and services. These include the following: i) Business and institutional environment, especially by means of creating a single EU-integrated market with adequate regulation and standardisation; therefore, EU competition and Single Market policies should take a vigorous lead on this and enable SMEs' interests to be better represented, especially in standard development and facilitating SMEs' access to patents and trade marks; ii) R&D and innovation cooperation between smaller/young companies with peers and with incumbents (including large-sized ones) leading in innovation, as well as enabling infrastructure and facilitator availability (public support for well functioning and growth of 'clusters' is certainly relevant for this, as public support to networking within and across the borders is a mechanism to enable SMEs to develop innovative products and processes); iii) Exploitation of the internationalisation potential of SMEs' goods and services market – lifting the barriers to small companies' cross-border operation – as well as for their inbound and external open innovation approach, and increasing firm's absorptive capacity for science, technology and innovation.

C. *Access to Financial Capital*
In general, serious market imperfections that affect SME performance can be found, in addition to product markets, especially in the capital and labour markets. From the literature and as highlighted in JRC-IPTS Workshop 2010 capital markets (e.g. risk-venture capital availability, access to loan guarantees) is vital for innovative firm growth. On the other hand, the SME size category appears to be the most sensitive (i.e. more than either large firms or micro-enterprises) to imperfections in the capital markets. Furthermore, financing constraints negatively affect the probability of setting up R&D activities, which is particularly relevant for SMEs eager to engage in R&D. Research suggests that improving legal and financial institutions helps all deserving firms improve access to finance and growth, but the effect is bigger on smaller firms than on larger ones. Both firm-level and industry-level studies suggest that small firms perform relatively better than large firms in countries with better-developed financial institutions and markets (Schiffer and Weder, 2001). Furthermore, empirical evidence shows (Beck and Demirguc-Kunt, 2006; European Capital Markets Institute, 2011) that when well-developed financial markets and legal

[24] For example, the need in the labour market for 'green' technical skills or negotiation and communication skills in SMEs can be achieved by improving or adding to the existing core skills of workers.

[25] In general, non-R&D innovators have lower innovative capabilities (i.e. abilities to develop more novel innovations) than R&D performing firms, with fewer non-R&D innovators capable of developing innovations in-house and a smaller percent reporting training or skill upgrading linked to innovation (European Commission, 2009).

systems are not present, it is difficult for firms to grow to their optimal size since outside investors cannot prevent appropriation by corporate insiders, limiting firm size. This is important for SME-promotion strategies, since if it is optimal for firms to stay small when the business environment has weaknesses, subsidising SMEs may be at best ineffective, but at worst, counterproductive.

Some of the key messages, related to the access to capital, relevant for policy arising from the latest EU conference on Corporate R&D and Innovation (European Commission, (2010d)■ can be summarised as follows:

- Support finance access for SMEs, especially with regard to R&D activities.
- Increase supply of and access to Venture Capital (VC) in Europe since VC increases the innovativeness (especially of NTBF). Distinguish tools and evaluation criteria with regard to supporting Community Ventures Corporation (CVC) and "INTERREG IVC" (it provides funding for inter-regional cooperation) across Europe since the two have different goals and different effects on innovation.
- Consider fiscal incentives for VC to help some public interest and priority innovative projects.

In summary, significant progresses have yet to be made on liberalising protected markets to help European businesses, especially SMEs, to be more innovative and grow.

D. *Entrepreneurial innovation culture and economy*

Promoting the (and removing obstacles for) entrepreneurial culture and activity is vital for a dynamic economy. Europe needs a societal model that supports risk-undertaking by innovative entrepreneurs and which does not over-penalise failures (according to OECD (2010) failure is an integral part of high-growth entrepreneurship). Enterprise creation and SME growth implies the necessary firms' 'creative-destruction' process, where many companies are set up and many others go out of business or suffer a restructuring process which implies job losses.. This process encounters significant obstacles[26] in the EU, undermining EU growth potential (Aghion et al., 2008).

Empirical evidence from a recent study by Stam et al. (2010) shows that growth-oriented entrepreneurship seems to contribute heavily to macroeconomic growth in both low- and high-income countries. In contrast to ambitious entrepreneurship in nascent and young businesses, established high-growth firms do not seem to contribute to macroeconomic growth as much as the former. In general, these established high-growth firms seem to flourish in countries with high levels of entrepreneurship ability.

The role of entrepreneurial activities has somehow been overestimated and there are many agencies operating in the market. Furthermore, many different public and private financing sources for starting a business overlap. However, after the starting period the entrepreneurs do not have a support in the continuing phases of their life cycle.

Therefore, an EU society innovation culture has significantly improved (towards a "EU Entrepreneurial Innovation Society"). This implies a citizen-driven innovation system (Vigier, 2007), and should underpin policy targets, accompanied by an innovation and entrepreneurial economy, which has also been determined by the industrial structure shifting towards small firms having a more important role, and where capital is not only invested in less risky mature business and firms, but there is more tendency in financing entrepreneurs with new ideas which need capital to transform them into successful new enterprises. Audretsch and Thurik (2010), who identified that the present 'entrepreneurial economy' is the evolution of the previous 'managed economy', argued that, rather than focusing on directly, and exclusively on promoting start-ups and SMEs, it may be that the current approach to entrepreneurship policy is misguided. They concluded that policy priority should rather be a more pervasive and encompassing approach consistent with an 'entrepreneurial economy' where the role of government policy is to enable the aim to foster the knowledge production and commercialisation, also developing a cultural enterprise value. Therefore, this also implies that institutions need to be strengthened before entrepreneurial resource can be deployed to drive innovation (Acs and Szerb, 2009).

[26] For example, as compared to the US in Europe there is more stringent bankruptcy regime (including laws, regulation, administrative complexities), and an entrepreneurial environment with more taxes, lower financial support availability, fragmented single market and less risk tolerance. (European Commission, 2010c; Gerhardt, 2009; Grilo and Thurik, 2008).

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Abstract

One of the main objectives of the new European research and innovation policy agenda is to favour the positive demographics (creation and growth) of EU companies operating in new/knowledge-intensive industries, especially Small and Medium Enterprises (SMEs). These companies play an important role in shaping the dynamism of the sectoral composition of the economy, favouring the transition towards more knowledge-intensive activities (smart growth) and in contributing to the overall objectives of economic growth and more and better jobs. But which kind of companies should be helped by policy? And how? This paper presents a literature review on the economics of research, innovation and competitiveness, focusing on the evidence available regarding the determinants for company creation and growth and the role played by Research, Development (R&D) and innovation. Furthermore, based on this, it draws a number of policy implications to design future research and innovation support instruments targeting innovative company growth in Europe.

The result of this work indicates that: a) the EU needs support policies to foster R&D investment in some specific typology of innovative companies and only where there are market failures and clear high social returns; b) the establishment of any targeted support instruments should take into account an integrated set of criteria including: firms' age and size, the sectors where firms operate, the involved risks in and potential for their innovative and commercial activities, the country/techno-economic environment, and the degree of internationalisation; c) to be successful, no matter the new targeted policies and supporting instruments, they should be designed using policy experimentation and its results should be regularly measured and evaluated using appropriate indicators and analyses.

The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies. As a service of the European Commission, the Joint Research Centre functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

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